Section I: Introduction and Background

Chapter 1 Introduction

1.1 Introduction

This document is the foundation for the IT Architecture for the Office of the Secretary. This plan supports the requirements of the Clinger-Cohen Act of 1996 which mandates that all Federal Government organizations develop and maintain an IT architecture. The architecture described in this document will also serve as a blueprint for the Digital Department initiative. The Digital Department initiative, which was announced by Commerce Secretary Daley, encompasses all of the processes, activities, and interactions that occur within the Commerce Department, and between the Commerce Department and its external stakeholders. It includes the private sector, Congress, the general public, etc. It is the goal to have as many of those processes and interactions done in an electronic manner as practical.[1]

1.2 Scope and Objectives

The scope of this document is to develop an Enterprise Information Systems Architecture (EISA) for the Office of the Secretary (OSEC). More specifically, it encompasses the administrative systems used by the Office of the Secretary, which are required to operate the organization. The goal is to develop a plan to migrate these systems from primarily paper-based systems to automated electronic systems accessible via a secure Intranet. This project is intended to support the mandate of the Secretary, that the Department of Commerce will be a Digital Department by the year 2002. In short, paper will be replaced to the extent possible, and within the confines of legal requirements, with Web based systems. These systems will provide access for DOC employees through a secure Intranet network, to systems and applications required to perform normal daily tasks.

Specifically, it covers all Department wide administrative functions and services, such as, but not limited to:

- Core financial system
- Human Resources
- Large procurement
- Small purchases
- Time and Attendance
- Asset Tracking
- Document management
- Travel

- Contract management
- Directory services
- Email
- Budgeting and planning
- Employee training
- Employee Information
- Help desk
- DOC Forms

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[1] The Digital Department Program Plan, Karen Hogan, U.S. Dept. of Commerce, 1999, pg 1

It does not cover systems providing services to external customers, or internal systems outside the realm of administrative functions.

1.3 Strategic IT Vision

The IT vision is to deliver "best in class" and cost effective IT services to achieve mission objectives and to guide the Department in realizing customer service and satisfaction goals into the 21st century. By utilizing current technologies, and keeping pace with technology advances, more services will be offered, be easier to access and use, and confirm the Department's role as a leader in service to its customers.

More precisely, the vision of the OSEC systems is that of deploying all administrative systems to the user community by means of Web enabled software. Additionally, the systems will be integrated to the extent that data common to multiple systems will be directly accessible by each system, expediting processing and eliminating "islands of data" throughout the enterprise.

In conjunction with business process reengineering efforts, process workflows will be streamlined and automated, eliminating the need for moving paper through the office to complete tasks. Sophisticated digital security and authentication techniques will be employed to substantiate origin of data and the validity of authorizations and approvals as required for task completions.

A secure, department wide Intranet will serve as the backbone for the application platform, and provisions will be made to allow remote and mobile users to access the Intranet while maintaining all security requirements. Once constructed, this system will allow all employees to complete all administrative tasks using secure online Web based applications from any location. It will improve overall efficiency of these tasks, provide more information to managers more rapidly, and expand the scope of what can be performed in the future.

1.4 Enterprise Information System Architecture Concepts

An Enterprise Information System Architecture (EISA) is a tool which defines the IT goals of the organization as they relate to the business requirements of the operational entities. The EISA defines the mission, the information required to perform the mission, the technologies needed to perform the mission, and the transitional processes for implementing new technologies in response to changes in the mission over time[2]. It provides a framework for planning IT strategy and for implementing a consistent, cost effective and manageable environment for the organization to perform its tasks.

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[2] U.S. Customs Enterprise Architecture, Robert Thomas, 1999, pg. 3.

There are multiple levels within an EISA, each conforming to the level of abstraction of the Enterprise model. For the purposes of this document, the views as defined in the **Federal Enterprise Architecture Conceptual Framework** [3] will be used. The views provide a logical picture of the architecture at differing levels of abstraction.

1.5 Enterprise Level

The Enterprise Level encompasses the entire organization. It is a macro view of the business and technology components that make up the organization. It describes the major pieces, including the current and target architectures, the architecture segments and models, the transitional process to achieve the target, and the standards and principles which govern the transition. Figure 1.3.1 shows the conceptual model of the level 1 view.

Figure 1.1 Level 1 View of Architecture Model
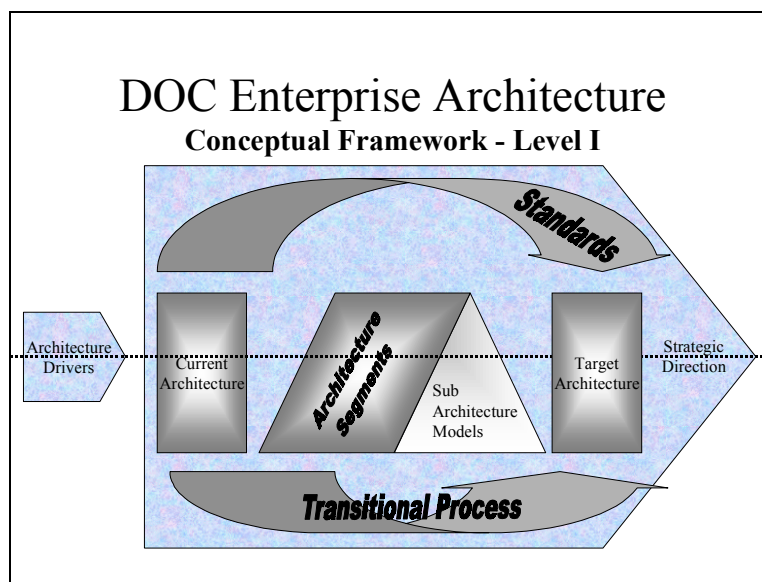
The level 1 view is useful in supplying context of the component views, but in and of itself provides insufficient detail to be useful to planners or developers. It shows the internal components of the enterprise, as well as the external forces that drive change of the enterprise.

1.6 Enterprise Sub-Component View

The sub-component or Level II view begins to dig into the organizational structure, detailing the segments which makes up the architecture. Each segment is composed of a business model and a technology model. The segments represent a major organizational process, and should not be confused with IT systems or organizational structures. In

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[3] Federal Enterprise Architecture Conceptual Framework, Federal CIO Council - Conceptual Model Subgroup, August 1998, pg. 10-14

Enterprise Information System Architecture Plan   3

most instances, these segments are composed of many systems and cross organizational boundaries. Figure 1.2 shows the Level II view. This level is important in that it defines the major tasks of the organization, and gives them context in the larger enterprise view.

**Figure 1.2 Level 2 View of Architecture Model**
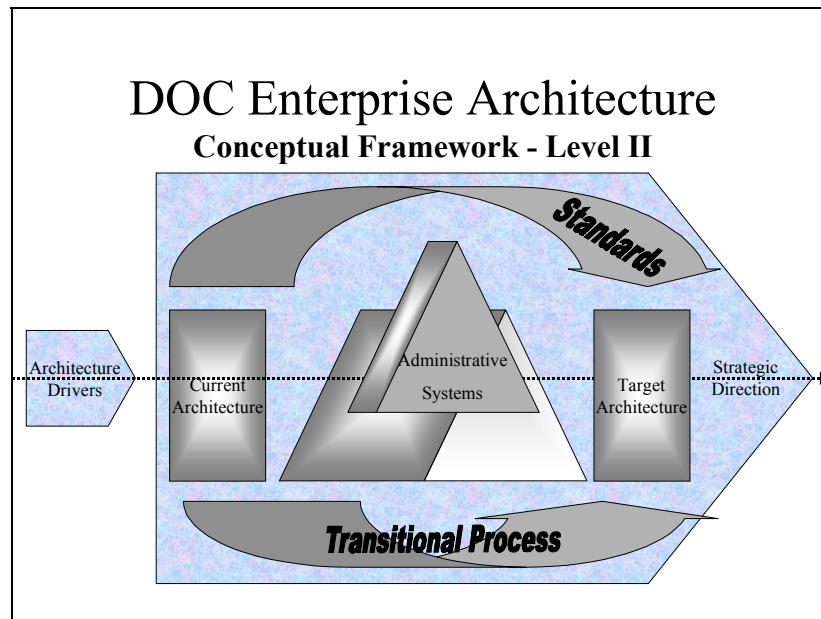
When viewed vertically, the top half of this view details the business of the enterprise, and the lower half catalogs the technologies used to support the business functions. An important note is that the relationship between the business and technology components is a push/pull one. Business requirements push technology to provide new and better means of performing work, and technology advances pull business to new levels of service delivery in support of business operations.[4]

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[4] Federal Enterprise Architecture Conceptual Framework, Federal CIO Council - Conceptual Model Subgroup, August 1998, pg. 10-14.

1.7 Segment View

The Segment view is a further excavation into the architecture. This Level III view shows the components of an individual architecture segment. For this document, it is the primary level that work will be performed. Specifically, the Administrative Functions segment. Most of this document concentrates on this area, however, it can be applied in a more general sense to any segment. Each segment has specific traits that are different from other segments, necessitating differences in approach at this level. Figure 1.3 shows the Segment view.

Figure 1.3 Level 3 View of Architecture Model
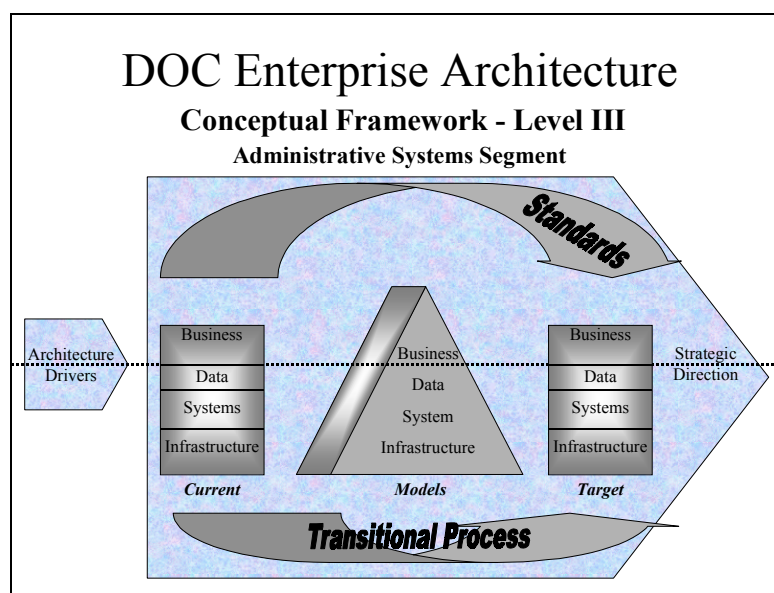
The Segment level begins dealing with specific systems and functions. It can be composed of a family of related systems and functions with a significant level of integration, or a single system and function that does not interact with others at all. A segment is typically a major subsection of the enterprise, such as Administrative Functions in the DOC plan. At this level the major work processes, data flows, system components and infrastructure elements are defined along with the models which represent these areas. Also at this level specific standards are applied and the details of the transition process start taking shape.

1.8 Segment Sub-Architecture View

This is the most detailed level of the architecture. It focuses in on a single task, and the data, system, and infrastructure components required to perform that task. Beyond this level are the actual system design, functional specification, and infrastructure requirements documents. This Level IV view shows how a specific business function fits into the overall architecture, and gives context to the principles and standards which will be employed to develop the target architecture for this function. It encapsulates all the information about a business function without delving into specifics of design or requirements. Figure 1.4 details this view.

Figure 1.4 Level 4 View of Architecture Model
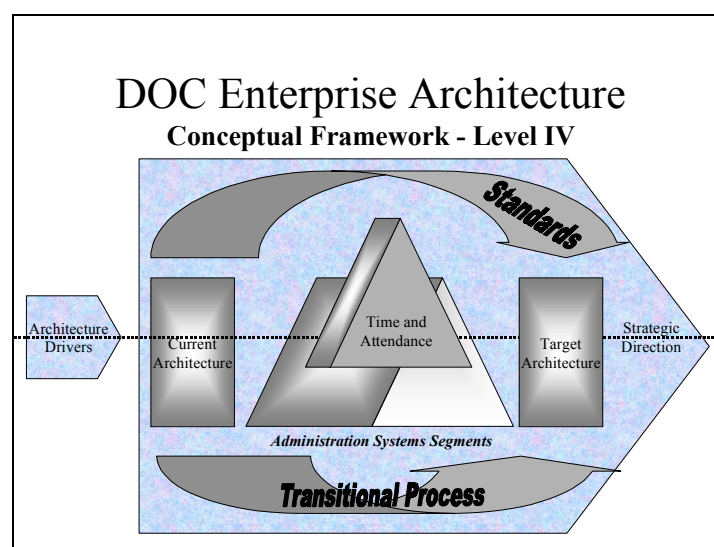
This is the level where the implementation teams begin. It provides the team with a context for the system within the segment and the enterprise, without constraining their design efforts so heavily as to erode system flexibility within its own sphere of work.

1.9 How to use this document

This document, or any EISA, is used at several different levels. First, it is a component of the Strategic Planning process in that it enables planners to view the Enterprise Architecture and formulate plans for future growth within a defined framework. It also aids in development of the Operational Plan in that it demonstrates how specific component changes or additions fit into and affect the overall architecture.

A second use of an EISA is in budgeting. Since it describes the integration of the Enterprise, it can help leverage procurements by achieving economy of scale for software and hardware purchases. In many instances, new components will make use of existing

technologies, and licenses can be extended to cover additional requirement at a reduced cost.

The third use of this document is for system planners and implementers.   It provides a view of the Enterprise in sufficient detail to allow new projects to be "plugged in" to the existing framework. It documents all interactions between systems. It also shows how new capabilities can be added with minimal integration and development. The EISA functions much as a blueprint, allowing the user to view the level of detail required to make informed choices on how to add onto the existing construction with minimal impact.

1.10 Benefits of the Enterprise Information Systems Architecture

The goal of the EISA is to enable the Department to develop systems that meet the needs of the business functions of the Department in the most efficient manner. The EISA will provide the mechanism to achieve the following desirable characteristics of information systems:

- **Interoperability**: The ability of systems to operate on shared data and execute a consolidated workflow to perform one or more task without manual intervention to move or transform data.

- **Scalability**: The ability to handle growth. It enables the user base and/or workload to increase by addition of more processor power or servers, without redesign or reworking of the system except to recognize the additional resources. In short, it has the inherent capability to handle from 1 to N users where N can be up to 50,000+.

- **Portability:** The ability to move the applications and data from one platform to another with minimal recoding. Taken to the highest level, it implies true platform independence, which is the most desirable state in that it allows hardware to be purchase based on best price/performance alone.   It also means that end-user platforms can be of multiple types with no affect on availability of services or additional development requirements.

- **Maintainability:** No system is ever complete. There are always new requirements as the system evolves. Maintainability is the property concerned with how easy it is to make evolutionary changes with the least impact on the system and development resources. Modular components with high degrees of encapsulation, strict data typing and a functional meta-data dictionary are key components of this feature. It's long term savings in programmer resources and faster time to deploy offset the initial startup costs of implementation.

- **Affordability:** There are many ways to view this. The most common approach is to look at the one time investment cost to acquire the system. A newer concept, total

cost of ownership (TCO), takes into account initial investment as well as longer term recurring costs such as maintenance contracts, upgrades and support. This approach is the one used in this document. COTS software packages will be used preferentially over in-house development only where it makes good business sense based on TCO. Additionally, all COTS products will be required to meet specific criteria (as defined in the DOC Technical Reference Model) for scalability, maintainability, portability, and interoperability where appropriate. These same criteria apply to in-house development as well, but are much simpler to control).   It is a case of simple economics, the most cost effective solution for the life span of the application is the one that should be taken. In purchasing COTS software, one must also consider the critical nature of the application, and the long-term stability of the vendor. If the vendor fails, in many cases, the product has no future, and a conversion to a new package would be required in one to three years. The more critical the application, the more this should be a consideration.

Chapter 2 Overview of the Office of the Secretary

The primary function of the administrative segment of the Office of the Secretary is to perform the necessary support functions required to operate and manage a large diversified organization. It provides services to the OSEC staff, as well as to the Department as a whole. Although most of the business units of the Department function with a high level of autonomy, many processes must pass through the OSEC for approval or review.
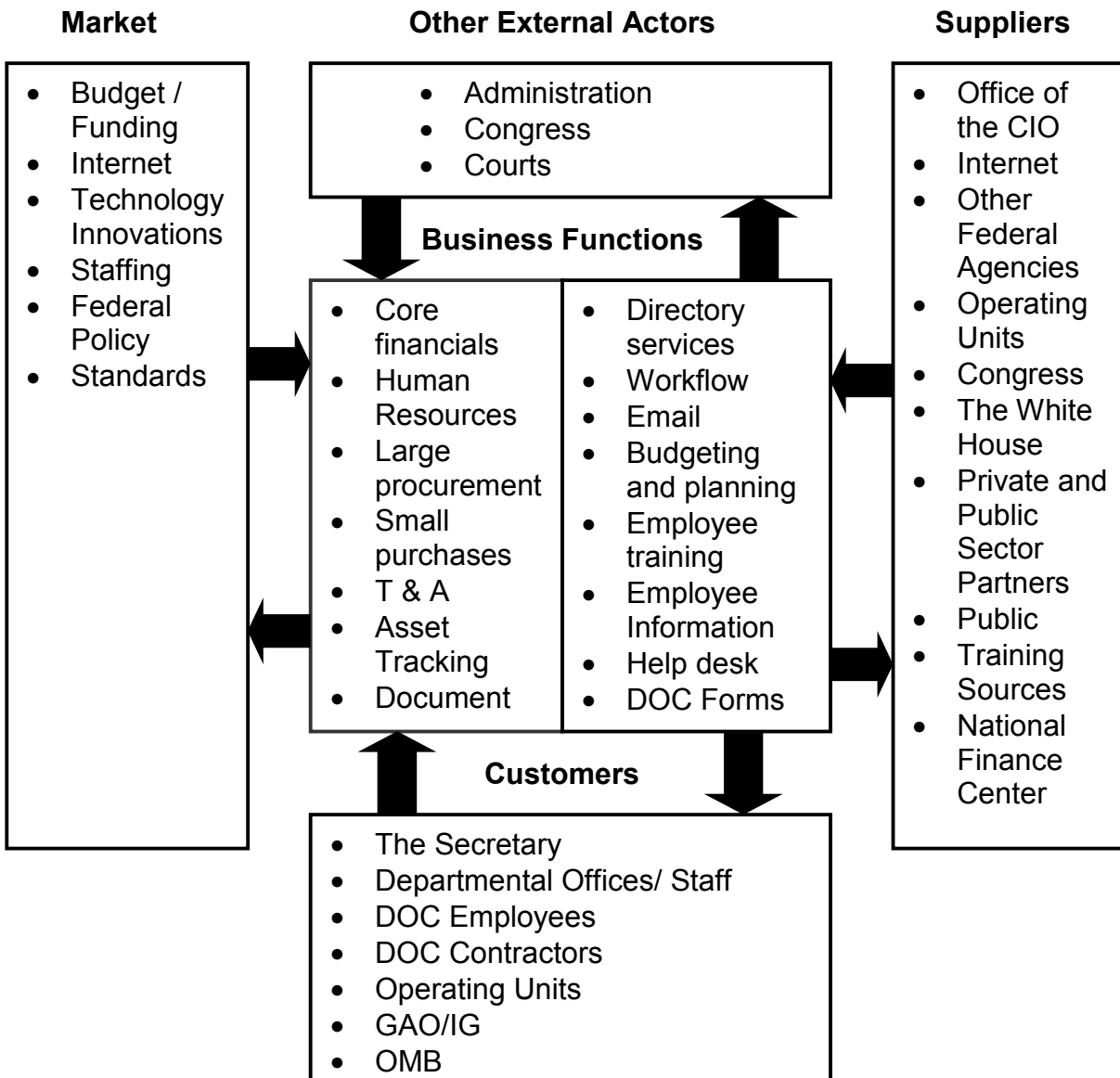
2.1 Office of the Secretary Organization and Mission

This IT Architecture Plan covers the immediate Office of the Secretary which consists of a number of "Departmental Offices" that have organization wide responsibilities or perform special program management functions directly on behalf of the Secretary of Commerce. The chart in Figure 2.1 illustrates the basic structure of the administrative functions for the OSEC. An organization chart is included in figure 2.2, followed by a description of the activities of each unit.

2.2 Business Architecture

The current Business Architecture is mostly non-specified. Organizationally, the administrative functions of the OSEC are handled by individual line offices that have no clear mandate to communicate data, share processes and resources, and improve the efficiency of the tasks they are assigned. There have been many improvements over the last few years in automating individual functions, but no attempt outside of the CAMS (**C**ommerce **A**dministrative **M**anagement **S**ystem) effort to build an integrated system for the OSEC, or the Department as a whole. It is critical to the success of the Digital Department effort that the processes and tasks are reviewed, and altered if needed, before the software development effort begins. It is also important that business rules are developed, as well as standard operating procedures, both of which can then be enforced by the software systems that are deployed.

Figure 2.1 Office of the Secretary Business Context Diagram

Market	Other External Actors	Suppliers

Market
- Budget / Funding
- Internet
- Technology Innovations
- Staffing
- Federal Policy
- Standards

Other External Actors
- Administration
- Congress
- Courts

Business Functions
- Core financials
- Human Resources
- Large procurement
- Small purchases
- T & A
- Asset Tracking
- Document

- Directory services
- Workflow
- Email
- Budgeting and planning
- Employee training
- Employee Information
- Help desk
- DOC Forms

Suppliers
- Office of the CIO
- Internet
- Other Federal Agencies
- Operating Units
- Congress
- The White House
- Private and Public Sector Partners
- Public
- Training Sources
- National Finance Center

Customers
- The Secretary
- Departmental Offices/ Staff
- DOC Employees
- DOC Contractors
- Operating Units
- GAO/IG
- OMB

Organizational Structure of the OSEC

Office of the Secretary
U.S. Department of Commerce

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                    ┌─────────────────────────┐
                    │  Secretary of Commerce  │
                    └─────────────────────────┘
                    ┌─────────────────────────────┐
                    │ Deputy Secretary of Commerce │
                    └─────────────────────────────┘
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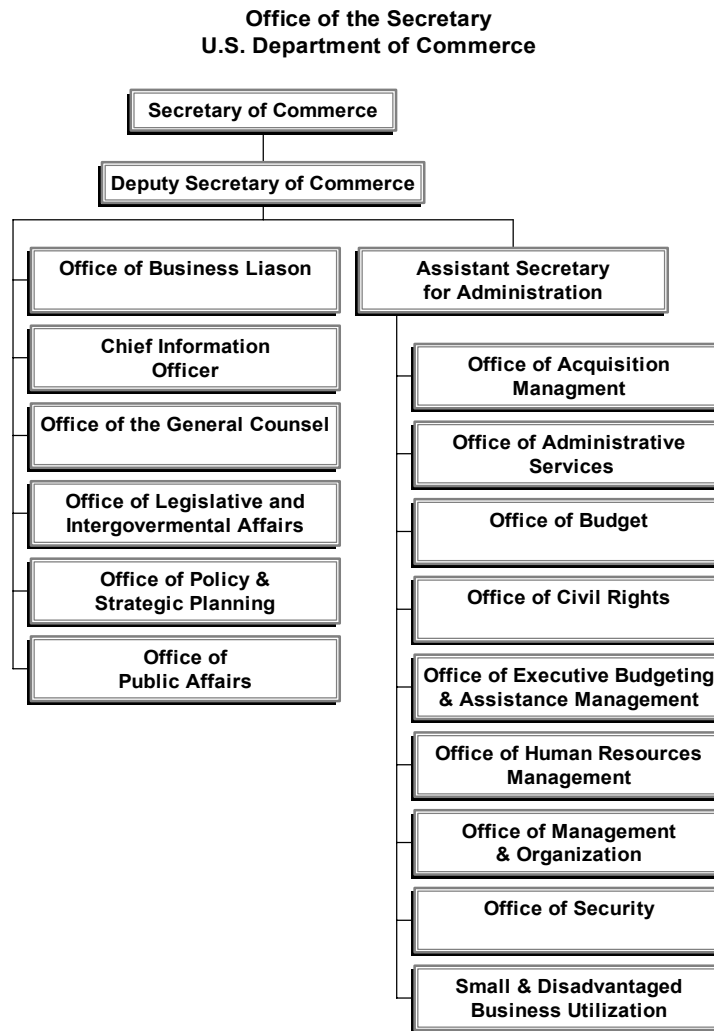| Office of Business Liason	Assistant Secretary for Administration
Chief Information Officer	Office of Acquisition Managment
Office of the General Counsel	Office of Administrative Services
Office of Legislative and Intergovermental Affairs	Office of Budget
Office of Policy & Strategic Planning	Office of Civil Rights
Office of Public Affairs	Office of Executive Budgeting & Assistance Management
	Office of Human Resources Management
	Office of Management & Organization
	Office of Security
	Small & Disadvantaged Business Utilization

Figure 2.2 Organization Chart for the Office of the Secretary

2.2.1 Staff Offices

- *Business Liaison* - Serves as the primary point of contact between the Department and the business community for information sharing and issue resolution activities.

- *General Counsel* - The chief legal officer of the Commerce Department.

- *Legislative and Intergovernmental Affairs* - The principal advisor to the Secretary on matters of legislative and Congressional issues, except those functions assigned to the Office of General Counsel and Assistant Secretary for Administration, respectively.

- *Policy and Strategic Planning* - Advises the Secretary on policy issues and directs issue-based and Departmental strategic planning initiatives.

- *Public Affairs* - The Department's point of contact for news media, organizations and the general public seeking information about Commerce Department programs, policies, procedures, statistics, research and services. Assists the Secretary on all public affairs and strategic communications matters. Serves as liaison with the White House and Executive Branch agencies on public information matters.

2.2.2 Administrative Offices and Chief Financial Officer

- *Acquisition Management* - Provides an acquisition environment that promotes the achievement of program missions while protecting the public interest.

- *Administrative Services* - Provides all administrative operations, including publications and graphics, copy center, personal property, fleet management, library and other special services, electronic subscription services, building and space management, health and safety policy, real property management.

- *Budget* - Prepares and defends the Department's annual Congressional budget request. Also supports long-range planning, Department-level budget execution activities, supports development of performance measures and helps Operating Units implement Commerce Department budget procedures and policies.

- *Chief Information Officer* - Manages the IT program and all related resources for the Department. Procures resources for the implementation of IT. Develops and implements Department-wide policies for use of IT to conduct Department business. Provides leadership for specialized programs such as Year 2000 compliance and Digital Department. Provides guidance for the Chief Information Officers in the Department's Operating Units; i.e., roles and responsibilities, IT plans, IT security, budget initiatives, and IT architecture;

- *Civil Rights* - The Chief Advisor regarding Department responsibilities under all statutes, Executive Orders, and regulatory provisions relating to equal employment

opportunity, nondiscrimination, and civil rights.

- *Executive Budgeting and Assistance Management* - This office is responsible for a variety of administrative functions. These include developing and managing the budget for the Office of the Secretary and other Commerce Department offices, establishing and implementing policies and procedures, and providing operational support for grants management, travel management, forms and records management, and advisory committees. It is also responsible for carrying out the Department's responsibilities under the Freedom of Information Act and Privacy Act and administering the Department-wide Post Secondary Internship Program.

- *Financial Management* - Formulates and prescribes Department-wide financial management, accounting, fiscal policies, procedures, and controls, as well as provides assistance to Departmental Operating Units in its implementation of the Commerce Administrative Management System (CAMS).

- *Human Resources Management* - Strives to provide the work force toolkits and training to continuously improve individual and organizational performance to ensure mission accomplishment.

- *Management and Organization* - Consists of a team of management and program analysts who perform numerous cross-cutting organizational functions vital to the effective operations of the Department.

- *Security* - Directs and administers the Department's security programs, to include personnel, physical, information, operations security, counterintelligence and security awareness.

- *Small and Disadvantaged Business Utilization* - Responsible for promoting the use of small, minority, and women-owned businesses in compliance with Federal laws, regulations, and policies. It also assists such firms in obtaining contracts and subcontracts with the Commerce Department and its prime contractors. Sets strategic direction for the Department in small businesses matters, and evaluates performance.

2.2.3 Office Locations

The majority of the OSEC staff and work locations are in the Herbert C. Hover building located at 14th and Constitution Avenue in Washington, D.C. There is also a computer center located in Springfield, VA, which houses some of the equipment used to perform administrative functions. It also provides service to other areas of the Department, as well as other government agencies.

2.3 Technical Infrastructure

The technical infrastructure is decomposed into four primary domains: network, system hardware, operating system software and tools, and application software and tools. Each of these will be examined in more detail later. The graphic below depicts the current layout of the network for the Office of the Secretary and connections to the Internet and to other operating units within the department. This will no doubt be one of the first items to undergo significant change. The current physical plant is not able to sustain broadband communications, nor is it robust enough to sustain the load of a full network-computing environment.

Figure 2.3 Current OSEC Network Configuration
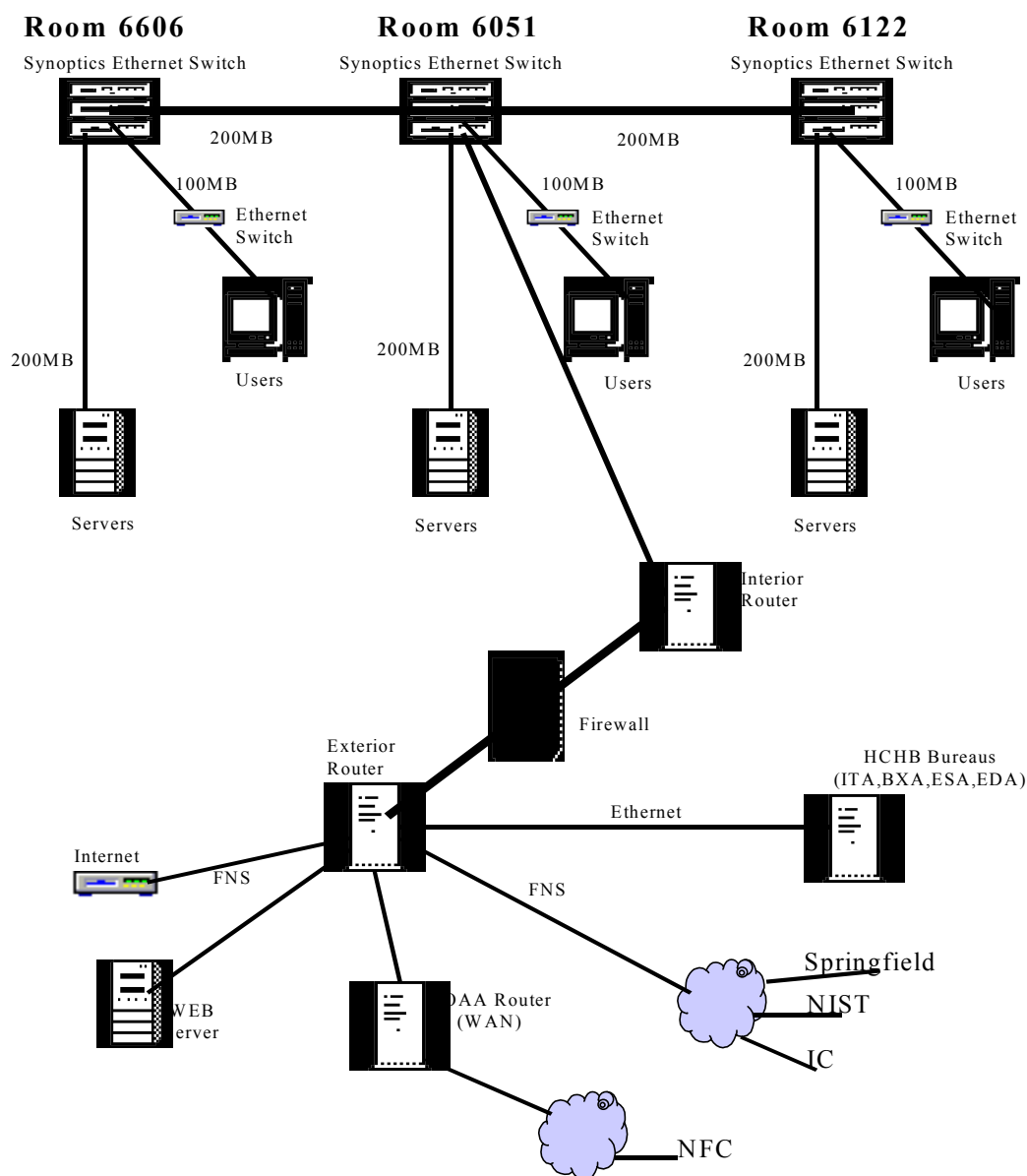
The current network operating system is Banyon Vines, which is outdated and in many aspects, incompatible with Intranet development and use. The product is being decommissioned by the vendor within the next year, so some migration is required.

The current desktop environment is a mixture of several different models of Intel based Microsoft Windows platforms. They range from old Intel 486 processors running Microsoft Windows 3.1 to brand new systems with Pentium III processors running Windows 98 or Windows NT4.0. The only real problem here is that as Web content becomes more multimedia oriented, the slower processors and older software versions will have a progressively more difficult time in providing acceptable levels of performance.

The datacenter systems are comprised mostly of Novell and Windows NT servers, with some processing performed by the IBM Mainframe system in the Springfield data center. Most if not all of these systems are close to state-of-art due primarily to Y2K issues involving the older servers. As with the network, the main issue here is sufficient capacity, in this case I/O bandwidth and processing resources. This area will be monitored on an ongoing basis, as each new application is deployed.

2.4 Data Architecture

As with the other areas, there is no formal data architecture at this time. The information that exists in most cases is contained in system and application documentation. The CAMS system has a data dictionary, but it is not tied to any of the other functions, so although it is useful for that project, it does not propagate the information to a wider audience of applications. The systems that employ fully SQL compliant database packages exercise some level of data verification, but as this is not done across all applications, its efficacy is not what it should be.

Chapter 3 Architecture Principles

Architecture Principles are statements of preferred direction or practice. They are simple, direct statements of how an organization wants to use information technology (IT) in the long term.[5] The principles are used to develop a framework in which IT planning and development are carried out. The intended audience of the principles is the IT staff, in particular the system designers who make decisions on how to implement systems to perform business functions.

Architecture principles are intended to guide the Department in developing a sustainable, cost effective, flexible and maintainable environment. They are essential in achieving interoperability between systems and organizations. Principles establish the doctrinal guidelines that are essential for all components to operate within to achieve the intended goals of the enterprise. They set the bounds and establish the context within which the enterprise can succeed. The current state of most organizations is that they embody no such precepts. Therefore, the architecture is a chaotic riot of diverse, unmanageable components that do not adequately fulfill the requirements of the organization. Work is done, but at a much higher monetary cost, and a greatly protracted timeline. By establishing and adhering to the architecture principles, cost can be reduced and processes optimized.

The principles are broken down into different views: General, Business, Data, Systems, and Infrastructure. Each view focuses on specific components of the architecture, and provides guidance to developers on how these principles can be implemented, and why they should be implemented wherever possible.

3.1 Architecture Views
The views can be defined as follows:
- General View - covers overall guidelines relating to fundamental concepts for any organization to function (also known as Meta view).
- Business View - describes how IT is used to implement the business functions. It focuses on general concepts of implementation.
- Data View - focuses on the data and information required to perform the Department's mission.
- Systems View - centers on the applications and interfaces, and their interrelations across the enterprise.
- Infrastructure View - defines the computer hardware, software, and communication networks and their interaction and interdependence.

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[5] Bureau of the Census Enterprise Information Architecture Plan, ITT Research
   Institute, October 1999, pg. 3-1.

3.2 General Principles

Table 3.2.1 General Architecture Principles

GP1	All systems and applications should adhere to Department and Federal privacy standards and these standards should be available for users to read.
GP2	Data and systems should be protected from malicious attack or other unlawful incursions commensurate with the potential harm and potential risks that would result from loss or misuse of the systems or data.
GP3	Common business processes will be implemented in a consistent fashion to maximize interoperability and reuse, and minimize user-training requirements.
GP4	All information system activities shall be conducted in accordance with all applicable laws, orders and regulations.
GP5	All applications deployed to the Office of the Secretary, or to the public should be accessible by persons with disabilities to the extent possible.
GP6	System development or procurement should conform to a coherent set of Open System standards adopted by the Office of the Secretary.

3.3 Business Principles

Table 3.3.1 Business Architecture Principles

BP-1	Data should be captured electronically at the earliest possible point in a process, and never be transcribed to move between applications or systems.
BP-2	Applications should be integrated only to the extent required by the business functions they perform.
BP-3	System development should be driven by business case analysis.
BP-4	Operational units should be fully engaged with IT staff in specification and selection of applications.
BP-5	Applications and Data should be available to users regardless of physical location.

3.4 Data Principles

Table 3.4.1 Data Architecture Principles

DP-1	Data exchanges should either be direct, or use tagged file formats.
DP-2	Data archive and disaster plans should be developed and implemented to cover all significant data stores, from the desktop to the datacenter.
DP-3	Data updates must maintain the integrity of the data.
DP-4	A data dictionary should be developed and its use enforced for all common data elements.
DP-5	All data should be captured explicitly, there should be no implied information based on context.

3.5 System Principles

Table 3.5.1 System Architecture Principles

SP-1	Each application should clearly specify input data formats
SP-2	Applications and software tools should be Web enabled and platform independent.
SP-3	The incorporation of COTS software MUST NOT inhibit integration, scalability, or portability
SP-4	All applications must be capable of interacting with all security applications, such as digital certificate, public key encryption, and digital signature where applicable.
SP-5	All system must be maintainable and reliable (some components must be 24x7)
SP-6	All systems should include full documentation, disaster plans, and provide a means to backup all critical data.

3.6 Infrastructure Principles

Table 3.6.1 Infrastructure Architecture Principles

IP-1	Primary servers should provide sufficient redundancy to ensure that work is not lost or delayed due to equipment failures.
IP-2	Network hardware should provide sufficient bandwidth to minimize data transfer delays and user timeouts.
IP-3	All system and network hardware should conform to industry wide standards, and use of-the-shelf components.
IP-4	Navigation of the Intranet should be transparent to the end user, all applications and services should be available without requiring the user to know their location.
IP-5	Firewalls and other security features should be employed to the extent required to meet Federal and Department requirements.

The listed principles are a beginning, and by no means a complete or comprehensive list. They will evolve over time as standards are adopted and as technology changes. It is important however to establish a baseline to work from and to use in planning for a three to five year period. These principles should be reviewed for relevancy on a periodic basis, and changed or added to as situations dictate.

Each set of principles is fully detailed in Appendix A, giving the rational behind it as well as an explanation of the relevancy. These detailed descriptions should assist the developers in utilizing these principles in a consistent fashion.